DOUBLE PLAY SYSTEMS

SUMMER COOLING & WINTER HEATING

PURPOSE

It is time for a fundamental change in how we heat and cool buildings, time to reduce extravagant burning of fossil fuels. New understanding, new tools and materials make this possible. No subsidies or elaborate research projects are required.
A meeting to discuss the promise of heating and cooling using unglazed collectors and related systems will be held at Zomeworks Friday November 8, and Saturday November 9, 2002.

THE SYSTEM

Primary system elements consist of unglazed water-filled radiator/absorbers used both outside and inside, inside water storage tank(s), and plumbing which connects these elements in a typical series loop. The tank may double as the inside radiator or may connect to separate inside radiators. The outside radiator cools at night during the summer and absorbs heat during the day in winter. Night-cooled water is circulated between radiator and tank by convection. In winter, a small PV pump typically feeds the absorber, allowing automatic drain-back at night for freeze protection. Because system temperature differences are low, inside R/A's must have large surface areas for adequate thermal coupling to the conditioned space.

PROOF OF CONCEPT

A basic version of the system has been operating in a small building at Zomeworks since 1999. Weekly records of hourly ambient and inside temperatures verify system effectiveness in both cooling and heating modes, and will be available at our meeting. All attendees are urged to visit and inspect this system.

TOPICS

Outside Radiators/Absorbers

SECTION I

a. Revised loss coefficients for unglazed collectors
b. Flow Factors: Flow rates for night cooling and day-heating
c. Area Ratios: Inside floor to outside radiator/absorbers
d. Surfaces, colors and emissivities
e. Flow patterns, typical restrictions, air purging requirements
f. Plastic materials: extruded or blow molded tubes and mats
g. Metal Materials: classic "flat plate" panels, metal roofing in copper, aluminum, or steel with integral pipes comparative conductivities.
h. Freeze tolerance of plastic vs. metal thermosyphon walls
i. Drainback roofs, slope requirements for thermosyphons
j. Expansion tanks; size and locations
k. Freeze penalty: typical thawing times
l. High performance of Swiss S.S. selective surface absorber
m. Standard pool collectors; FAFCO, US solar
n. Seasonal changeover: valves, pumps, water-level adjustment
o. Spray Roofs

INSIDE RADIATOR/ABSORBERS AND STORAGE

SECTION II

a. Typical storage requirements, # / SF of floor area climatic influences
b. Insulated storage tank(s) coupled to radiators on ceilings or walls
    capability of daily turnaround during change in seasons
c. Storage integral with radiator/absorber, ceiling, wall, or floor
    Ceiling pipes vs. wall pipes
    Pipe-section profiles; round, rectangular, other
    Cost of pipe supports
    Provision for pipe replacements
    Cleaning inconvenience, beneficial spider-spaces?
d. Effects of storage mass
e. Thermal coupling to space in cooling and heating modes
    Radiant vs. convective contributions
    Coupling controls with shutters, fans or curtains
    IR – Reflective walls or ceilings
f. Experiments with push-in piping connectors

SAFETY OF STORAGE IN WALLS OR OVERHEAD

SECTION III

a. Structure for support and seismic stability must meet applicable codes
b. Abrupt ruptures: provision for rapid drain to outside
c. Slow leaks: sliding bands for spot clamping, tape sealants, isolating valves
d. Other?

SECTION IV

SPEAKERS TO BE ANNOUNCED

ECONOMICS

SECTION V

a. Estimated installation cost with ceiling storage: Metal roofing radiator/absorber, inside tanks and plumbing, shutters, controls, extra structure, backup heating,
    field verification required on cost of all system elements
b. Comparison with installation cost of conventional systems with mechanical or evaporative cooling, furnace or boiler heating
c. Operating cost vs. conventional systems
    Backup heating load, Albuquerque climate
    Annual savings; electricity, propane, water
d. Preliminary estimate of simple payback period

TYPICAL APPLICATIONS FOR MARKET-ENTRY

SECTION VI

a. All should have low ventilation loads, and preferably be located at sites not served by natural gas

Warehouses	Machine Shops
Hi-end self storage	Specialty residential
Commercial vehicle storage	Low occupancy offices
Equipment sheds	Low occupancy factories
	Farm building

TOOLS FOR UNDERSTANDING SYSTEM PERFORMANCE

SECTION VII

a. Infrared video cameras and scanners
   Heat plates outdoors at various controlled fluxes
   Measure surface temperatures in various wind conditions
b. Orientilt diagrams (heating only)
   Rapid readout of insolation changes from variations in absorber tilt and orientation
c. Computer modeling of system performance
   Help will be gratefully acknowledged and appreciated

FOR DISCUSSION DURING MEETING

SYSTEM PROBLEMS/LIMITATIONS

SECTION A

1. High initial cost, mortgage-lender resistance
2. Market-resistance to unusual exposed components
3. Difficulty of daily turnaround in spring and fall
4. Loading limits in high air-change applications
5. Possible high cost of freeze-damage repair warranty
6. Retrofits typically cumbersome, often impractical
7. Outgassing from chlorinated hydrocarbons can be harmful (EPA)

SYSTEM ADVANTAGES

SECTION B

1. Silent operation
2. Independence from fossil fuels and grid-power
3. No water consumption, on or off site
4. Low maintenance requirement
5. Uniform temperature distribution, cooling and heating
6. No perceptible drafts in conditioned space
7. Periodic leaks may amuse the children

ABOUT THE MEETING:

It will be held in our shop (we normally work a 4 day week and the shop is free on Friday and Saturday.) We will be able to demonstrate shortcuts to understanding such as:

1. Building thermal models using blow molded children's toys and other products - plumbed with push in plumbing.
2. Easy way to judge flat plate collector effectiveness as radiator or absorber using a garden hose and IR scanner.
3. A look at U valves by comparing heated plate temperatures to unheated using an IR scanner.